

## Chemical Force Affected by Dilution      287

up together. Iron and lead show the alternations of state in the tube No. 2 as beautifully as copper (963).

966. *Strong and dilute sulphuric acid.*—I prepared an acid of 49 by weight; strong oil of vitriol, and 9 of water, giving a sulphuric acid with two proportions of water, and arranged the tube No. i (962) with this and the strongest acid. But as this degree of dilution produced very little effect with the iron, as compared with what a much greater dilution effected., I adopted the plan of putting strong acid into the tube, and then adding a little water at the top at one of the sides, with the precaution of stirring and cooling it previous to the experiment

(961).

967. With *iron*, the part of the metal in the weaker acid was powerfully positive to that in the stronger acid. With copper, the same result, as to direction of the current, was produced; but the amount of the effect was small. With silver, cadmium,, and zinc, the difference was either very small or unsteady, or nothing; so that, in comparison with the former cases, the electromotive action of the strong and weak acid appeared balanced. With lead and tin, the part of the metal in the *strong* acid was *positive* to that in the weak acid; so that they present an effect the reverse of that produced by iron or copper.

968. *Strong and dilute muriatic acid.*—I used the strongest pure muriatic acid in tube No. i, and added water on the top of one side for the dilute extremity (961), stirring it a little as before. With silver, copper, lead, tin, cadmium, and zinc, the metal in the *strongest acid* was positive, and the current in most cases powerful. With iron, the end in the strongest acid was first positive: but shortly after the weak acid side became positive and continued so. With palladium, gold, and platinum, nearly insensible effects were the results.

969. *Strong and dilute solution of caustic potassa.*—With iron, copper, lead, tin, cadmium, and zinc, the metal in the strong solution was positive: in the case of iron slightly, in the case of copper more powerfully, deflecting the needle 30° or 38°, and in the cases of the other metals very strongly. Silver, palladium, gold, and platinum gave the merest indications (961).

Thus potash and muriatic acid are, in several respects, contrasted with nitric and sulphuric acids. As respects muriatic acid, however, and perhaps even the potash, it may be admitted that, even in their strongest states, they are not fairly comparable to the very strong nitric and sulphuric acids, but rather to those acids when somewhat diluted (973).